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ECONOMIC FORECASTING: EFFECT OF ERRORS ON OASDI FUND RATIOS

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Abstract

This note analyzes experience during the 1970s for several key economic indicators reflecting changes in price levels, changes in wage levels, and unemployment. The assumptions adopted by the trustees of the Social Security funds were rather consistently on the optimistic side of the actual experience that emerged.

Acknowledging that forecasting such quantities is an inexact science at best, the authors present a formula for making estimates of OASDI fund ratios, given the necessary assumptions. The formula is used to project the OASDI fund from 1981 to 1986, showing where the fund would stand if forecasting errors were to continue at the magnitudes experienced in 1970-76.

Purpose

This note analyzes the effects of deviations of actual economic experience from that assumed in making financial projections for the cash benefits portion of the Social Security program (OASDI). This analysis may be useful to policymakers in making judgments about desirable fund levels and the choice of economic assumptions for alternative projections. It focuses on the OASDI fund ratio, that is, the assets for the two trust funds (OASI and DI) combined at the beginning of a calendar year as a percentage of anticipated expenditures in that calendar year. The fund ratio serves as a convenient, albeit crude, measure of short-range financial stability. In particular, it has been stated that a fund ratio of approximately 9 percent is needed to assure that the current monthly benefits will be paid on time and that a fund ratio of at least 20 percent would be needed to avoid risking cash flow problems due to cyclical fluctuations in the program and its economic environment.

Introduction

The financial condition of the Social Security system is getting considerable attention. The principal reason for this is that since calendar year 1975, OASDI disbursements have exceeded income in every year. This trend is projected to continue for a few more years.

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Social Security is financed on an essentially pay-as-you-go basis with the trust funds serving primarily as contingency reserves. In earlier times, when the fund ratio was higher, there was greater capacity for the program to withstand financial adversity. However, with the OASDI fund ratio standing at below 20 percent in early 1981, such margins no longer exist. In fact, current projections show that without corrective action it is a virtual certainty that the trust funds will be depleted in late 1982.

Projections and Levels of Economic Activity

Many variables affect the short-range financial operations of OASDI. However, short-term behavior is most strongly influenced by those variables relating to levels of economic activity, including: increases in the CPI which result in automatic adjustments in benefits, changes in average annual wages in covered employment; and, the average unemployment rate. These variables interact subtly. For example, average annual wages in covered employment are linked to employment levels. In contrast to more stable and predictable variables such as mortality, disability, and retirement rates, these economic variables do not exhibit the same type of gradual and discernible long-term trends. In addition, it is now widely recognized that forecasting economic variables, even over short periods of time, is likely to produce significant forecasting errors.

The annual reports of the Board of Trustees of the Old-Age and Survivors Insurance and Disability Insurance Trust Funds have included three sets of financial projections to indicate future income and outgo under a range of assumptions.* One set of assumptions is designated as optimistic, another pessimistic, and the third intermediate. The particular sets of assumptions are so characterized depending on whether they have a favorable or unfavorable effect on the estimated financial status of the trust funds. The intermediate assumptions and the projections based thereon are intended to be best estimates. The three sets of assumptions and projections together indicate a range of costs under reasonable conditions, and thus are indicators of future financial stability. There cannot, of course, be assurance that costs will actually fall within the range of the projections for any year or period of years.

It should be noted that little discussion to date has been given to setting standards for determining what is a proper spread between the optimistic and intermediate sets of assumptions, or between the intermediate and pessimistic. In recent years it has also become apparent that greater consideration should be given to short-term economic assumptions and their relationship with OASDI financing. Some questions might include the following: Can or should the pessimistic set of assumptions be established so we would expect actual experience to be more favorable with some level of confidence? Should the optimistic set be similarly established? Should financing of the system be set so that the system will not require additional financing over some minimum period of years even under economic experience significantly more adverse than assumed in the intermediate set?

*Five sets of short-range economic assumptions were included in the 1981 OASDI report.

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In testing alternative sets of assumptions, it is convenient to have a short-cut method of approximating the fund ratios without preparing a full-scale projection based on all the essential parameters. We believe that the formula presented in the Technical Appendix could be used as such a short-cut method. One should recognize that alternative assumptions may affect the individual Trust Funds (for OASI and DI) in slightly different ways. One should also recognize that other variables (e.g. disability incidence rates and rates of retirement) are subject to forecasting error that can also affect OASDI fund ratios, although probably to a lesser extent in the short range than the key economic variables. Furthermore, levels of economic activity may have secondary effects upon these other variables. Therefore, the suggested formula should be regarded as a way of computing a first approximation to the actual change in fund ratio. The formula has been used here to analyze the effect on the OASDI fund ratio of past forecasting errors in the principal economic variables for the intermediate set of assumptions. (By forecasting error, we mean the difference between the actual value of a variable and the value assumed for it in a particular projection.) These "errors" are, of course, an inherent part of forecasting and the use of the term is not meant to imply mistakes or oversights.

Forecasting Errors Made in Past Trustees Reports

Table 1 shows for each calendar year from 1970 through 1980 the actual values for the following variables: increase in the implicit GNP price deflator; increase in the CPI; increase in average annual wages in covered employment; real wage differential; and average rate of unemployment. Table 1 also shows for calendar years 1975 through 1980 the automatic OASDI benefit increases that have become effective due to changes in CPI.

Table 2 shows the intermediate set of assumptions for three key economic variables for each of the first five projection years (but not past 1980) in each Trustees Report from 1970 to 1979 inclusive.

Table 3 shows for the first five years of the projections the forecasting errors, the differences between actual and assumed experience, in each Trustees Report from 1970 to 1976 inclusive for three key economic variables. These forecasting errors will be used to develop alternative sets of assumptions as described later. Prior to 1975, there were no automatic increases in social security benefits. Thus, the reports of 1970-1974 did not make a projection of the automatic benefit increase, but instead projected price increases, either through increases in the GNP price deflator (1970 report), or increases in the CPI (1971-1974 reports). We believe, however, that, based on these variables, the forecasting error of the 1970 report for GNP deflator and the forecasting errors of the 1971-1974 reports for increases in CPI reflect the forecasting errors that would have been made if projections of the increase in the first quarter average CPI (the measure by which benefits are now automatically adjusted) had been made. One should, of course, recognize that the 1970-1974 reports were done in an era when OASDI operations were not tied by statute to inflation and so its prediction was of less consequence.

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One should exercise caution in trying to give a probabilistic interpretation to these past errors, since the probability distribution of the different variables is not known. It is noteworthy that errors in the '70s were consistently on the optimistic side. Nevertheless, an analysis of past forecasting errors should provide some useful indication of the range of deviations in OASDI fund ratios that might be expected in the future due to errors in forecasting of economic variables. In particular, we are interested in the range of the fund ratios that are likely in the first five years of a projection, based on intermediate assumptions.

Effect on Projected Fund Ratios of Repeating Past Forecasting Errors

Table 4 shows the key economic variables for the intermediate (II-B) and pessimistic sets of assumptions in the 1981 Trustees report. In addition, it shows the projected OASDI fund ratio for these two sets of assumptions at the beginning of each calendar year from 1981 through 1986.

Table 5 shows seven alternative sets of short-range assumptions for the key economic variables. Each of these alternative sets is obtained by modifying the 1981 II-B set by introducing the forecasting errors shown in Table 3 for each of the 1970 through 1976 Trustees Reports in turn. Thus, the "1971" modification changes each value from the 1981 II-B set by adding the corresponding forecasting error from the 1971 Trustees Report according to the number of years projected into the future (duration).

Table 5 also shows OASDI fund ratios for 1981 through 1986 for each of these alternative sets. These figures represent the approximate OASDI fund ratio that would result if the specified economic assumptions were realized, and all other assumptions in the 1981 II-B set were also realized.

Chart A displays the formula differences in OASDI fund ratios produced by the forecasting errors of the Trustees reports of 1970 through 1976. We can see that the forecasting errors of those sets of assumptions produce formula differences for fifth year fund ratios that range from 9 to 42 percentage points. Three of these sets produce formula differences of over 20 percentage points. The interested reader may use these differences to determine OASDI fund ratios if alternative economic sets had been developed from the 1981 II-A set rather than the II-B set of assumptions.

Conclusions

This note has presented data illustrating the sensitivity of emerging OASDI fund ratios to variations in the level of economic activity and how the effects of forecasting errors will snowball in a few years. In considering the adequacy of program financing, policymakers should take into account the extent to which forecasting errors require financing plans which provide for a degree of safety margin, thereby permitting the program to operate in an orderly manner despite adverse experience.

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TECHNICAL APPENDIX

The preparation of the projected OASDI trust fund ratios under alternative assumptions as to the economic variables used in the analysis in this Actuarial Note was facilitated by use of the approximation discussed below.

Let F_n^a be the fund ratio at the beginning of year n+1 under the alternative set of economic assumptions a, and let $DF_n^{a,b}$ be the difference in trust fund ratios at the beginning of year n+1 between alternative sets of economic assumptions a and b. Clearly $DF_n^{a,b} = F_n^a - F_n^b$. Let us define the auxiliary function B_t^x by,

$$B_t^x = W_t^x - 0.5(A_{t-1}^x + A_t^x) - 1.3(U_t^x - U_{t-1}^x),$$

where W_t^x is the change in average annual covered wages in percent in year t under set x of economic assumptions; A_t^x is the percent change in benefits due to an automatic increase in year t; and U_t^x is the average rate of unemployment in the year t. Then,

$$\sum_{t=1}^{n} (n-t+1)\,(B_t^a - B_t^b)$$

provides a reasonable estimate of $DF_n^{a,b}$.

The principal assumptions in this approximation are:

1. The benefits, benefit formulae and taxable wages are indexed as in present law;

2. Annual expenditures and income are in approximate balance;

3. There is a 30-percent excess effect on covered payroll due to changes in unemployment; and,

4. The interest rate applicable to the trust fund equals the growth in expenditures.

Examination of this formula makes clear the sensitivity of the trust fund ratios to small changes in the economic variables. Let it be assumed for example that two alternative sets of economic assumptions are identical with the single exception that the first year's projected change in nominal wages is 1 percentage point greater in set a than set b. In this case,

$$B_t^a - B_t^b = 0, \text{ if } t > 1 \text{ and, } \quad B_1^a - B_1^b = W_1^a - W_1^b = 1\%,$$

$$\text{therefore, } DF_n^{a,b} = n\%$$

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The reasonableness of this result may be seen in the following way: since outgo will be identical under both sets and income under "a" will be 1 percent higher in each year the fund ratio at the beginning of the second year of the projection under "a" is one percentage point higher, two percentage points higher at the beginning of the third year, etc.

This seemingly minor difference will thus snowball into a fund ratio higher by 5 percentage points after 5 years, not a small change in a period when trust fund exhaustion is imminent in the absence of corrective legislation.

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TABLE 1

ACTUAL VALUES FOR KEY ECONOMIC VARIABLES, 1970-1980 1/

Calendar Year	Increase in GNP Price Deflator	Automatic Benefit Increase	Increase in CPI	Increase in Average Annual Wages in Covered Employment	Real Wage Differential	Average Unemployment Rate
1970	5.4%	N/A	5.9%	4.9%	-1.0%	4.9%
1971	5.0	N/A	4.3	4.9	0.6	5.9
1972	4.2	N/A	3.3	7.3	4.0	5.6
1973	5.7	N/A	6.2	6.9	0.7	4.9
1974	8.7	N/A	11.0	7.4	-3.6	5.6
1975	9.3	8.0%	9.1	6.6	-2.5	8.5
1976	5.2	6.4	5.8	7.9	2.1	7.7
1977	5.8	5.9	6.5	7.3	0.8	7.0
1978	7.3	6.5	7.6	8.0	0.4	6.0
1979	8.5	9.9	11.3	9.3	-2.0	5.8
1980	9.0	14.3	13.5	8.5 (est.)	-5.0 (est.)	7.2

1/ Increase is with respect to prior year.

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TABLE 2

ECONOMIC VARIABLES 1970-1979 TRUSTEES REPORTS
(INTERMEDIATE SETS OF ASSUMPTIONS)

Trustees Report of	Year	Prior Year's Inflation rate 1/	Increase in Average Annual Wages in Covered Employment	Average Unemployment Rate
	1970	4.7%	5.5%	4.2%
	1971	4.3	5.2	4.2
1970	1972	3.5	4.4	4.0
	1973	2.9	4.4	4.0
	1974	2.4	4.4	4.0
	1971	5.9%	6.0%	5.2%
	1972	4.3	8.2	4.4
1971	1973	3.5	6.1	4.0
	1974	3.1	5.5	4.0
	1975	2.8	5.2	4.0
	1972	4.3%	6.0%	5.5%
	1973	3.1	5.8	5.0
1972	1974	2.9	6.0	4.2
	1975	2.8	5.5	4.0
	1976	2.7	5.1	4.0
	1973	3.3%	7.1%	4.7%
	1974	4.5	6.9	4.5
1973	1975	3.0	6.3	4.5
	1976	2.8	5.2	4.5
	1977	2.8	5.2	4.5
	1974	6.2%	7.9%	5.8%
	1975	9.1	8.5	5.8
1974	1976	5.7	8.0	4.8
	1977	4.5	7.6	4.5
	1978	3.2	5.5	4.5

1/ The figures shown opposite 1970 Trustees Report represent the increase in the implicit GNP price deflator, and the figures shown opposite the Trustees Reports of 1971-1974 represent CPI increases.

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TABLE 2 (CONCLUDED)

ECONOMIC VARIABLES 1970-1979 TRUSTEES REPORTS
(INTERMEDIATE SETS OF ASSUMPTIONS)

Trustees Report of	Year	Automatic Benefit Increase	Increase in Average Annual Wages in Covered Employment	Average Unemployment Rate
	1975	8.0%	6.2%	8.8%
	1976	6.6	9.0	8.0
1975	1977	6.4	11.0	7.0
	1978	6.3	8.8	6.2
	1979	4.8	7.7	5.4
	1976	6.4%	7.7%	7.7%
	1977	5.9	8.5	6.9
1976	1978	6.0	9.4	6.6
	1979	5.8	8.5	6.2
	1980	5.2	7.7	5.7
	1977	5.9%	8.4%	7.1%
	1978	5.5	8.1	6.3
1977	1979	5.2	7.8	5.7
	1980	5.0	7.1	5.2
	1978	6.5%	7.2%	6.3%
1978	1979	6.1	7.9	5.9
	1980	5.9	7.9	5.4
1979	1979	9.8%	8.3%	6.0%
	1980	7.8	8.0	6.2

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TABLE 3

FORECASTING ERRORS FOR KEY ECONOMIC VARIABLES
IN 1970-1979 TRUSTEES REPORTS

Inflation Rate or Automatic Benefit Increase 1/

Year of Report	Year of Projection: Current Year	2nd Year	3rd Year	4th Year	5th Year
1970	0.4%	1.1%	1.5%	1.3%	3.3%
1971	0.0	0.0	-0.2	3.1	8.2
1972	0.0	0.2	3.3	8.2	6.4
1973	0.0	1.7	8.0	6.3	3.0
1974	0.0	1.9	3.4	1.3	3.3
1975	0.0	-0.2	-0.5	0.2	5.1
1976	0.0	0.0	0.5	4.1	9.1
1977	0.0	1.0	4.7	9.3	-
1978	0.0	3.8	8.4	-	-
1979	0.1	6.5	-	-	-

Increase in Average Annual Wages in Covered Employment 2/

Year of Report	Year of Projection: Current Year	2nd Year	3rd Year	4th Year	5th Year
1970	-0.6%	-0.3%	2.9%	2.5%	3.0%
1971	-1.1	-0.9	0.8	1.9	1.4
1972	1.3	1.1	1.4	1.1	2.8
1973	-0.2	0.5	0.3	2.7	2.1
1974	-0.5	-1.9	-0.1	-0.3	2.5
1975	0.4	-1.1	-3.7	-0.8	1.6
1976	0.2	-1.2	-1.4	0.8	0.8
1977	-1.1	-0.1	1.5	1.4	-
1978	0.8	1.4	0.6	-	-
1979	1.0	0.5	-	-	-

1/ The numbers shown are the differences between actual experience and what the intermediate set assumed as shown in Tables 1 and 2 respectively. The numbers shown for the 1970 Trustees Report are the difference between actual and assumed percentage increases in the G.N.P. price deflator. For the 1971-1974 Trustees Report the numbers are the difference between actual and assumed percentage increases in the CPI. A positive number indicates a Trustees Report underestimated the inflation rate or automatic benefit increase as the case may be.

2/ The numbers shown are the differences between actual experience and what the intermediate set assumed as shown in Tables 1 and 2 respectively. A positive number indicates a Trustees Report underestimated the increase in average annual covered wages.

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TABLE 3 (CONCLUDED)

FORECASTING ERRORS FOR KEY ECONOMIC VARIABLES
IN 1970-1979 TRUSTEES REPORTS

Average Unemployment Rate 3/

Year of Report	Year of Projection: Current Year	2nd Year	3rd Year	4th Year	5th Year
1970	0.7%	1.7%	1.6%	0.9%	1.6%
1971	0.7	1.2	0.9	1.6	4.5
1972	0.1	-0.1	1.4	4.5	3.7
1973	0.2	1.1	4.0	3.2	2.5
1974	-0.2	2.7	2.9	2.5	1.5
1975	-0.3	-0.3	0.0	-0.2	0.4
1976	0.0	0.1	-0.6	-0.4	1.5
1977	-0.1	-0.3	0.1	2.0	-
1978	-0.3	-0.1	1.8	-	-
1979	-0.2	1.0	-	-	-

3/ The numbers shown are the differences between actual experience and what the intermediate set assumed as shown in Tables 1 and 2 respectively. A positive number indicates a Trustees Report underestimated the rate of unemployment.

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TABLE 4

1981 INTERMEDIATE (II-B) AND PESSIMISTIC SHORT RANGE ECONOMIC ASSUMPTIONS AND PROJECTED OASDI FUND RATIOS

Assumption Set	Year	Automatic Benefit Increase	Increase in Average Annual Wages in Covered Employment	Average Umemployment Rate	OASDI Fund Ratio at Beginning of Year
1981 Intermediate (II-B)	1981	11.2%	10.2%	7.8%	18%
	1982	9.7	9.6	7.5	13
	1983	9.2	9.7	7.2	7
	1984	8.5	8.8	7.0	2
	1985	7.7	8.1	6.8	- 5
	1986	----	----	---	- 8
1981 Pessimistic	1981	11.2%	11.5%	7.9%	18%
	1982	13.4	10.9	8.0	13
	1983	11.4	11.1	8.8	7
	1984	11.0	11.4	7.9	- 2
	1985	10.1	10.1	7.4	-12
	1986	----	----	---	-17

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TABLE 5

ALTERNATIVES TO 1981 TRUSTEES REPORT SHORT RANGE INTERMEDIATE (II-B)
ECONOMIC ASSUMPTIONS BASED ON 1970-1976 TRUSTEES REPORT
FORECASTING ERRORS AND PROJECTED OASDI FUND RATIOS

Assumption Set	Year	Automatic Benefit Increase	Increase in Average Annual Wages in Covered Employment	Average Unemployment Rate	OASDI Fund Ratio at Beginning of Year
"1970" 1/	1981	11.6%	9.6%	8.5%	18%
Modification	1982	10.8	9.3	9.2	11
	1983	10.7	12.6	8.8	2
	1984	9.8	11.3	7.9	- 6
	1985	11.0	11.1	8.4	-13
	1986	----	----	----	-16
"1971" 1/	1981	11.2%	9.1%	8.5%	18%
Modification	1982	9.7	8.7	8.7	11
	1983	9.0	10.5	8.1	2
	1984	11.6	10.7	8.6	- 6
	1985	15.9	9.5	11.3	-16
	1986	----	----	----	-29
"1972" 1/	1981	11.2%	11.5%	7.9%	18%
Modification	1982	9.9	10.7	7.4	14
	1983	12.5	11.1	8.6	11
	1984	16.7	9.9	11.5	5
	1985	14.1	10.9	10.5	-10
	1986	----	----	----	-25
"1973" 1/	1981	11.2%	10.0%	8.0%	18%
Modification	1982	11.4	10.1	8.6	13
	1983	17.2	10.0	11.2	5
	1984	14.8	11.5	10.2	-11
	1985	10.7	10.2	9.3	-32
	1986	----	----	----	-50
"1974" 1/	1981	11.2%	9.7%	7.6%	18%
Modification	1982	11.6	7.7	10.2	13
	1983	12.6	9.6	10.1	0
	1984	9.8	8.5	9.5	-15
	1985	11.0	10.6	8.3	-34
	1986	----	----	----	-47
"1975" 1/	1981	11.2%	10.6%	7.5%	18%
Modification	1982	9.5	8.5	7.2	14
	1983	8.7	6.0	7.2	8
	1984	8.7	8.0	6.8	- 2
	1985	12.8	9.7	7.2	-13
	1986	----	----	----	-22
"1976" 1/	1981	11.2%	10.4%	7.8%	18%
Modification	1982	9.7	8.4	7.6	13
	1983	9.7	8.3	6.6	7
	1984	12.6	9.6	6.6	- 1
	1985	16.8	8.9	8.3	-12
	1986	----	----	----	-26

1/ The value for a variable in a particular modification is obtained by adding to the assumed value from the 1980 II-B set of assumptions, the corresponding forecasting error from Table 3.

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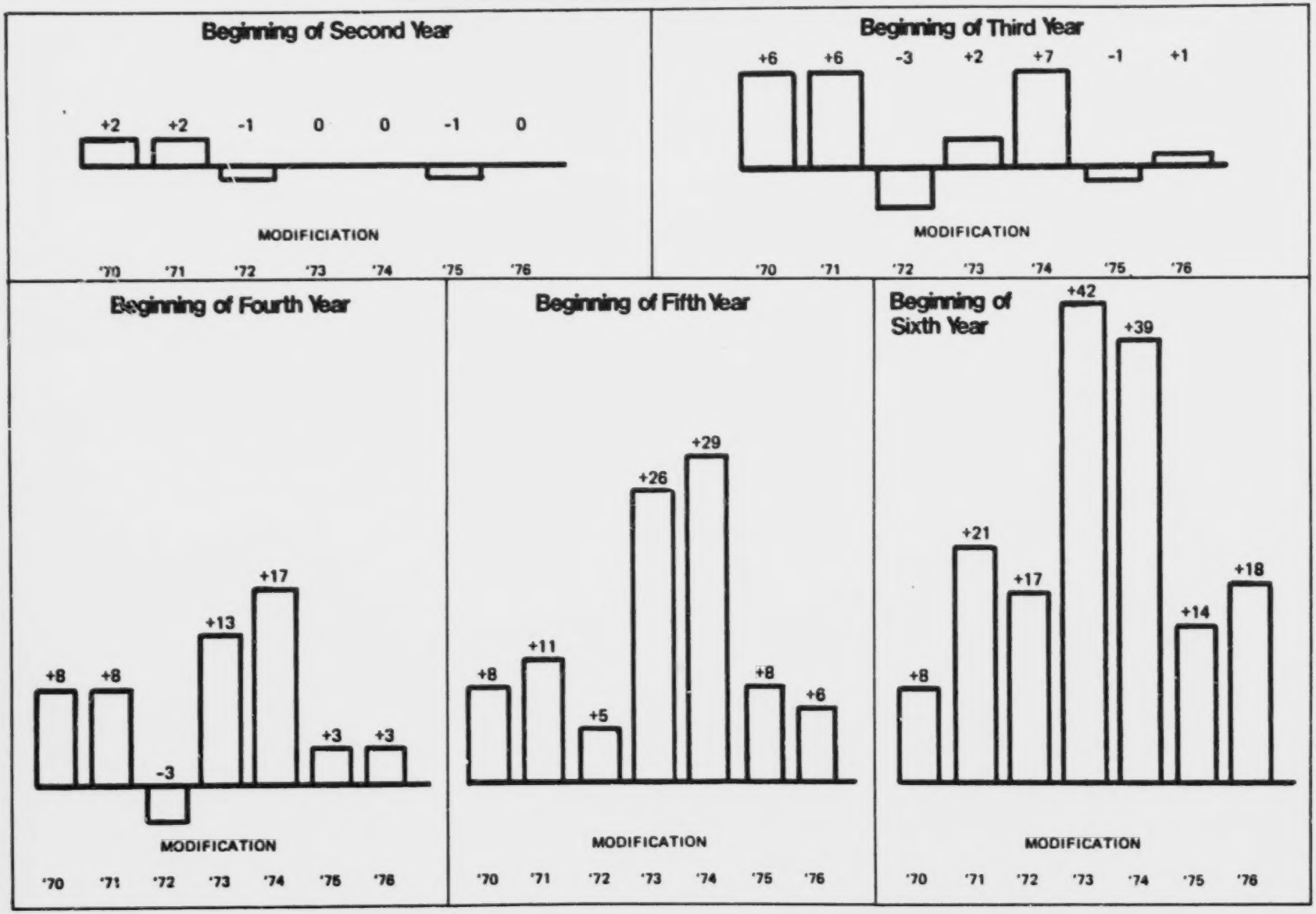
CHART A

DIFFERENCES IN PROJECTED OASDI FUND RATIOS [INTERMEDIATE ESTIMATE MINUS ALTERNATIVE ESTIMATE OF FUND RATIO IN PERCENTAGE POINTS] BASED ON ALTERNATIVE ASSUMPTIONS OF TABLE 5


Beginning of Second Year
+2 +2 -1 0 0 -1 0
MODIFICIATION
'70 '71 '72 '73 '74 '75 '76
Beginning of Third Year
+6 +6 -3 +2 +7 -1 +1
MODIFICATION
'70 '71 '72 '73 '74 '75 '76
Beginning of Fourth Year
+8 +8 -3 +13 +17 +3 +3
MODIFICATION
'70 '71 '72 '73 '74 '75 '76
Beginning of Fifth Year
+8 +11 +5 +26 +29 +8 +6
MODIFICATION
'70 '71 '72 '73 '74 '75 '76
Beginning of Sixth Year
+8 +21 +17 +42 +39 +14 +18
MODIFICATION
'70 '71 '72 '73 '74 '75 '76

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